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AUTHOR Anang, Arlene; Mitchell, Bruce
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ABSTRACT

The purpose of the study was to find out if and how the subject matter of a remedial high school classroom interacted with the social organization of that classroom and the differences it made. Two classrooms with different subject matter (mathematics and social studies) were observed over the course of a school year. The multiple awarenesses and perspectives of one of the teachers, an observer, and some students who were in both classes were compared and contrasted. Interactions between the teacher, the students, and the subject matter were analyzed to see how students' and teachers' goals and expectations overlapped and how patterns of instructional and classroom behavior were negotiated and mediated between the participants. This analysis gave insight into how the context of the classroom affected the forms of knowledge to which students were presented and their opportunity to learn in each setting. (Author)

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STUDENT, CONTENT, AND TEACHER INTERACTIONS IN A SECONDARY SCHOOL GENERAL MATHEMATICS AND SOCIAL STUDIES CLASSROOM

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Arlene Anang
Bruce Mitchell
Institute for Research on Teaching
252 Erickson Hall
Michigan State University
East Lansing, MI 48824

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Purpose

The purpose of this study was to examine how a specific ninth-grade General Mathematics class is affected by the social organization of the classroom in which it was taught. The assumption is that teaching is a dynamic process consisting of various kinds of interactions which work together to create an environment for learning. In order to understand the form subject matter takes for students, it is important to look closely at how the subject matter is translated by the teacher into daily activities, and how the teacher and students work together to produce the environment in which the activities occur. The dynamics of this process--the series of everyday events, are a crucial element in understanding the General Mathematics experience and what makes or prevents the class from being a rewarding and successful experience for teachers and students.

This particular portion of the study describes how one teacher and one group of students handled, interpreted, and reacted to mathematics in one setting over the course of a school year. This presentation is one part of a study which examined the relationship between subject matter and a population of students who have generally been unsuccessful in

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learning math. For the purpose of the entire study another class, social studies, with many of the same students was also observed for the same academic year. The focus was on student behavior in each of the two classes and the series of events, social and academic, to which students and teachers were reacting. Some of the comparative data will be used to illustrate and give added dimension to the descriptions of the mathematics class. This presentation, however, focuses on the problem of teaching General Mathematics and why it often turns out to be an unrewarding and unproductive experience for teachers and students alike.

Methodology

The methods used to gather data about the dynamics of this mathematics classroom were guided by the goals and purposes of two individuals. One person was the field researcher whose purposes were to describe how subject matter was affected by teachers, and students in the setting. The other person was the classroom teacher, also a research in mathematics education. His goals and purposes were related to the daily functioning of this classroom. The field researcher focused on the broad perspectives and changing patterns over the course of the school year while the teacher focused on the needs of the eight to 16 students and what he was going to do with them every day.

The regular conversations of these two individuals were an important sources of data for each person and served to keep each informed of the other's focus. The teacher, for example, was able to inform the researcher of the rationale for his lesson plans while the researcher was able to inform the teacher of changing patterns of group cohesiveness

and how he was applying long-range goals to daily lesson plans. The dual perspective increased the data about students also. The teacher kept track of students' learning and reactions to various activities while the researcher noted student interactions during various phases of the class hour and their frequency.

The researcher kept detailed notes which included attendance and seating patterns, student assignments, and teacher's and students' talk and behavior. The teacher's patterns of movement, calling on, helping. and monitoring students were also recorded. Five students (those who were also in the Social Studies class) were observed more closely to see how they were spending their time and the attention they were giving to various activities. The researcher also held a series of structured interviews with each of the five target students to learn more about their conceptions of the subject matter, their own learning patterns, and their understandings or perceptions of the two teachers' goals and expectations. The researcher also held more formal interviews with both teachers at the beginning and end of the year to first find out what their goals were for the year and how they planned to reach them, and then to find out how well the teachers felt they accomplished their goals and what they might do differently another year. The teachers also kept the researcher informed of daily objectives and students' grades and gave her copies of worksheets, study guides, and tests. The multiple sources of data were used in addition to the dual perspectives of both adults in order to give insight that went beyond descriptive data of <u>what</u> was going on, to explain <u>why</u> various activities were going on, as related to the goals of each individual.

Description of the Setting

The mathematics class was Foundations of Mathematics and was one of three alternatives available for ninth graders at this particular school. It was designed for students who were perceived to have either low ability or various forms and degrees of deficiencies in basic skills. It had a low student enrollment (varying from eight to 18 students) over the course of the year in order for the teacher to meet individual needs, provide maximum attention to the students and to maintain reasonable behavior in a situation (a classroom of low achievers) where unruly conduct was relatively common. The teacher was a white male who, unlike the social studies teacher, taught only this one class at the high school and spent the remainder of his working day teaching and doing research in mathematics education at a nearby university. He was characterized as being "easy going" and "easy to get along with" by his colleagues. He maintained relationships with students outside of class, usually related to sporting events, joked easily with them, and was generally considered very open and straight-forward with them.

The racial mix of the classroom was generally representative of the school itself, primarily white with small proportions of blacks and hispanics. There were, however, approximately twice as many boys as girls enrolled in the class at any one time. The school was the only high school in a town dominated by a major university. It has an excellent reputation in academics, sports, and innovative program support. The mathematics classroom was at one end of a wing known as "the math wing." It was furnished with 17 tables and chairs facing a room-length black-

board. The room could comfortably hold over 30 students, and with one third to one half that number in Foundations class, the students were able to spread out.

At the beginning of the year, the students generally chose to sit alone or in groups of two spread all over the room. At least one of these pairs of students demanded a lot of attention because of their poor behavior and a couple of the students who sat alone could easily be provoked into hostility. By the end of the year, all but two regularly sat on one side, mostly toward the front of the room. The seating changes corresponded with changing patterns of behavior and working together during those portions of each class hour when students did worksheets related to a specific topic or skill. Most of the hostility had ceased and the teacher was less overt in his behavior management, but still felt it necessary to be constantly watchful of a few students. The usual class hour consisted of some pre-class conversation between students or between teacher and students. These conversations were usually social in nature. The teacher often talked to one or more students about either local or national sporting events and their outcomes, school events, or issues of general interest while he was getting organized for class and taking roll. The students often sat around on chairs or table tops in groups of two's or three's talking quietly. There were no bells used at this school to mark the beginning or ending of class hours, so the beginning of class was marked by the teacher walking across the front of the room, closing the door, and saying something in a public voice or a structuring nature, such as, "There are really three things we

have to do today--multiplication of fractions, . . ." Alternate opening procedures were for the teacher to take role, asking aloud for the whereabouts of missing class members, or by returning graded papers.

The first part of most class meetings was used for a "board talk" where the teacher was at the front of the room writing and explaining problems on the board. He would ask questions, recitation style, which usually required short numerical answers from students such as, "How many fours would you expect in sixty rolls of the die?" These questions and answers were often of a rapid-fire sort, coming quickly, with the teacher's dialogue being punctuated with students' replies. During this portion of the class hour, the teacher attempted to minimize interruptions and emphasize the task at hand. He always tried to handle any behavior problems as quickly as possible in order to concentrate both his attention and that of the students on the demonstration at the board.

The board talk usually lasted from 10 to 20 minutes and was followed by a brief transition where the teacher passed out worksheets and the students would prepare for work by getting out their pencils and calculators. The remainder of the class hour (usually about 30 minutes) was spent with the students doing their worksheets and the teacher giving help to individuals and small groups. The students often helped each other and compared or checked their answers with other students while the teacher moved around the room. HIs priorities for directing his movement were first, to ward off or control behavior problems by keeping potential problem students oriented to the task; secondly, to give help when and where it was solicited by students; thirdly, to give

extended help where he thought it was needed; and fourthly, to monitor everyone's progress. Management comments made during this segment of activity reflected the teacher's priorities on the task and subject matter. An example of this was, "Hey, B., go back there (to your seat) so I can work with these people." The teacher helped individuals with their work by giving them alternative approaches, explanations, or methods of problem-solving. On some occasions he would support students by commenting on their progress—"You must be almost there." Occasionally, he would respond to a student's question by asking him or her to look at the reasonableness of an answer to see if it made sense. If a student had been working on a problem and was still having problems, the teacher asked a student to explain what he or she had tried, then he would explain the error, letting the student make corrections.

The teacher's stated goals were reflected in his daily planning and stated in formal and informal interviews. They were for the students to (1) learn some basic skills; (2) see the usefulness of the subject matter in the real world (applications); and (3) enjoy the subject and the class by giving the students what he called "interesting math problems that don't necessarily have to do with computing and calculation and adding, subtracting, multiplying, and dividing." These goals plus the teacher's collection of ideas and resources were the basis of the curriculum. He made up all of his own worksheets and tests, usually on a day-to-day basis, using students' responses (attitudinal and demonstrations of understanding) to gauge his pace. He covered all of the skills and basic topics that might be expected in a foundations level

course--division, fractions, decimals, and percents--usually in terms of "real world math" such as miles per hour, sales tax, and inflation rates. He also spent time on what he called "neat math" or "interesting problems" with probability, ratios, calculators, and topics in geometry that are not commonly covered.

Analysis

In order to examine how subject matter was affected by the social organization of the classroom, the forms in which teaching occurred and how the environment for learning was created, it is necessary to look at subject matter throughout the range of daily activities--how teachers and students interacted with it, and then how the teacher and students interacted with each other. On the surface, it was the subject matter that brought this particular collection of individuals together--the students were there to learn mathematics. Beneath the surface, there were the combined histories of students who had generally been unsuccessful with math and had developed negative attitudes, poor motivation, and some rather proficient avoidance behaviors. The interactions provide the insight into how subject matter was handled with this group of students and how it was translated from a body of knowledge into a series of daily lessons and activities.

As stated earlier, this teacher had three specific goals for his students: (1) to learn some basic skills; (2) to see the usefulness of the subject matter in the real world (applications); and (3) to enjoy the subject and the class. At the planning level, the teacher concentrated on looking for applications activities through which he

"could sneak in the fundamentals." The teacher knew that the students needed a lot of practice on basic processes and operations, but also knew that they resisted pure practice activities, such as sheets of problems on a single operation. They focused on which topics "they had had," not which topics they understood. He looked through newspapers for ideas to which he could relate basic skills such as inflation rates, sales tax, or miles per hour for new cars. On other occasions, he had them work on his check book balance or an erroneous hotel bill. On one occasion, planned as a review activity after the winter holiday break, the teacher passed out copies of a newspaper articles with the headline, "Gold prices soar to $649 amid worry." The lesson began with the question (written on the board), "If gold is $621 an ounce (in New York), what is the value of one pound?" So the first topic covered was the gold troy measure. He wrote, "One pound troy equals 12 ounces." They multiplied to find the price of a pound of gold, subtracted to find the difference between the new and old prices, divided to find the percent of increase, and used operations on decimals throughout these activities.

As he was looking for and planning these activities, the teacher thought about how individual students might react to these problems--who would have trouble and what kind of trouble they might have. On the first day of a sequence a new topic was presented, so individual preferences, learning styles, and differences were not a problem. The teacher introduced the topic and presented some practice activities. As he watched and helped the students with these practice activities,

he noted the range of abilities and specific needs of individual students. He would then try to incorporate this information into activities for the second or third day's activities--accomodating the content to specific individuals. The following day's worksheets might have problems which were geared to meet the needs of Joe, a relatively able student, or Mary who needed more practice on a specific concept.

The teacher always kept in mind how his students were handling the mathematics since his intention was to set up the course so that students could do well. Three things were done to insure their doing well: the first was just described--the teacher fit the daily activities to the specific students' needs in the group; secondly, he maintained a grading system which gave students some security and control over their grades by making 30% of the grade based on good behavior and observance of school rules. Being able to control this much of the grading process relieved the anxiety of failure for many of the students, and for a few, actually encouraged them to work harder than they might have otherwise. One student described in an interview how he felt about math now compared to how he had felt in previous years. In the past, he had been unsuccessful "no matter what (he) tried," and had generally given up. In this class, when he saw that he could achieve good grades (a visible sign of success), it encouraged him to take his worksheets home and redo the problems until he felt secure in his knowledge of the processes and operations. The third thing the teacher did to ensure success among his students was to give them a great deal of support as they worked. As he moved around the room during the seatwork portion of each class hour, he

complimented students on their achievement and always demonstrated willingness to help students in a variety of ways--he would reexplain a process, provide varied explanations, tell students if they were on the right track or had the right answer, and generally demonstrated great patience with each student. Every student interviewed talked about how important this pattern of individual help was to them.

R.W.: "(He'll) show you how to do it and (he'll) watch and show you what you're doing wrong and then when you get it right and (he'll) say 'Oh good'. . . and it really makes you work harder."

J.M.: "I learn the most if the teacher explains it to you, you know, the work and all that, then he lets you work at your own pace, and he finds out what you've done, and how good you've done it."

During these portions of the class hour, the teacher maintained low authority status. He usually let students' calls for help direct his movement, even if the calls were made loudly or in less than the most respectful ways. As he worked with students, the teacher usually bent down over the work and generally kept his eye level even with that of the student.

The teacher knew that the students' tendency or desire was to memorize. They wanted to know the "rule" or algorithm for doing an operation. Doyle (1979) referred to this as the students' need to reduce the ambiguity and risk of classroom tasks and to increase the probability and efficiency of task accomplishment. Doyle broke down academic tasks into three types based on the amount of ambiguity and risk involved in each. "Understanding" tasks involve the highest and

most complex level of thinking and also are highest in the amounts of risk and ambiguity for most students. A second level is called "procedural" because it involves learning a standard formula or procedure which can then be applied to a whole range of problems. This task involves less ambiguity because the formula is concrete and can be memorized. The easiest kind of task is "memory" and because they are easiest to accomplish successfully.

The teacher's pattern of support and willingness to manipulate grades to gain student cooperation encouraged students to attempt higher level tasks. He would tease students into rethinking answers or into expanding a numerical answer into a logical one. He would also encourage students to continue their thinking about a problem and consider the reasonableness of their answer rather than settling on any answer. He would assign extra credit to more difficult problems or those that required more complex operations or strategies. In this way, students didn't have to risk a low grade for an incorrect answer, but could benefit by gaining extra points if the problem was solved successfully.

The students' expectations of what mathematics was and their expectations for the class were communicated easily to the teacher and researcher alike. To them mathematics was doing basic operations—addition, subtraction, multiplication, division of whole numbers and fractions. The teacher spent a lot of time doing other kinds of things which he called "non-traditional enrichment topics" such as networks, mapping, symmetry, probability, etc. The students enjoyed these topics and generally did well, but they often asked when they were going to back to "problems."

The teacher's intent was to expand the students' notions of mathematics, and he was generally amused by the persistence of their limited definition.

The teacher focused his planning time and class time on subject matter. His management comments reflected an orientation towards work and the task at hand. Interruptions caused by student misbehavior were handled by telling the student how this behavior was affecting his teaching. "B., would you please be quiet so I can get some work done back here (with J.)." Informal interviews also reflect the teacher's orientation toward mathematics with numerous comments about students' interests, learning styles, and progress. In spite of all the data which demonstrates the teacher's concentration on subject matter and his students having successful experiences with it, he says that he always was concerned about discipline. He called it "an underlying awareness" because of the potential behavior problems that always existed. As he said, "Some kids are constantly doing something" to antagonize or provoke others.

The teacher's interactions with the students also focused on things other than their performance in math class. He tried to communicate a "genuine concern" and friendly interest in them as students. He asked about their outside interests and often attended school activities in which one or more of the students were participating. He speculated about how these foundations students were different from the geometry students he had taught other years. He said that the foundations students weren't as adept at using social skills to work for them as most of the geometry students either to placate teachers or to negotiate entry into the main social swing of this high school. He said, for example,

that the foundations students didn't seem to know about or understand the high school tradition of buying yearbooks and getting them signed.

The teacher's knowledge about this group of students affected his ways of working with them. With foundations student he wouldn't be concerned about the "best way" to present new ideas to the group--i.e., what format to use--as he was with geometry students. He was far more concerned with the content and how various individuals would react to it. Although he felt that the students needed concrete experiences with mathematical concepts, he also knew that they would have a negative reaction to using concrete manipulatives because they appeared to be "babyish." He also knew that there was a broad range of abilities in this group, so that there wasn't any one way of presentation that would be best for all of the students. The teacher also felt that this group of students, unlike the geometry students, did not learn as well by listening to an explanation as they did by going through the steps themselves. For that reason, he always felt that he was rushing through the explanation at the board so that the students could get started on their worksheets.

Comparative Data

Another class was also observed during this same academic year for the purpose of seeing how the subject matter of a class interacted with the social organization. There were several things in common about the two classes--they were in the same school, had many of the same students, they were both designated as foundations classes for students with low ability and/or various forms and degrees of deficiencies in basic skills,

they were both small classes, both teachers were white males of approximately the same age, were both characterized as being "easy going," and both had out-of-school contact with students in sports. The things that differed were the teachers' goals, daily focus, classroom organizational strategies, and the way they negotiated with students. Student behavior also differed.

The social studies teacher described his course in terms of topics to be covered for this year, which were the same for his regular social studies classes, but because the foundations students had reading problems or general problems with learning skills and would not be able to "make it" in a regular social studies class, he had different expectations for the two groups particularly in the amount of reading and interpreting he expected. He also felt it necessary to provide a greater variety of activities for this group—at least three for each class hour—because of their short attention spans.

This teacher also had an excellent academic background in social studies and also used his own knowledge and resources of the school for his curriculum. Neither teacher used a textbook. His daily focus was on the two or three activities students would engage in—usually consisting of a general skill activity such as spelling test or a graph-reading activity, and one or more content-giving activities such as a lecture, a film, or an oral reading. The activities were usually related to a common topic such as consumer economics, psychology, or career planning. Student expectation varied according to the task. Usually students were expected to listen to the reading, watch the film, etc. They

were also expected to complete any written tasks. The social studies teacher said that he tolerated more from this class in the way of noise and amount of movement. During interviews he focused on students' personal problems, academic limitations, and the best way to deal with them. For him, these problems and limitations were end points--factors which prohibited him from teaching and focusing on subject matter. The mathematics teacher, in contrast, treated student problems and limitations as beginning points, the place to begin his planning and instruction.

A second major difference was in the way the two classes were organized and the kind of student-teacher and student-student interaction the organizational structure promoted. The math class was divided into two segments--whole group, when the teacher was demonstrating from the board, and individual seatwork. The social studies class was conducted as whole-group, recitation style instruction for most of the time. The teacher dominated both the pace of instruction and the presentation of the subject matter. All students heard a single explanation of what to do and how to do it as well as the facts, procedures, or concepts to be learned. Student questions were treated publicly as were any comments related to behavior management. As a result, the social studies teacher had very few opportunities to work with or talk with students individually. His knowledge of them was limited to the formality of classroom recitations, test results, and whatever he could learn from other teachers or official school records. Since the teacher controlled all activity segments, there was very limited opportunity for students to work with

each other. Talk between peers was most often socially oriented and took place during transitions in activities or before and after class.

Another important difference in the two classes was the teachers' ways of dealing with student-mediating strategies. As stated earlier, the mathematics teacher did three things to ensure students' success—he fit the daily activities to the specific students' needs; he gave the students some control (30%) over their grades; and gave them a great deal of individual support as they worked. The social studies teacher negotiated for student cooperation and participation by reducing the elements of risk and ambiguity from the students by making the work easy. He reduced the concepts involved in the subject matter to a series of things to be memorized—definitions and facts. Even very complex issues were reduced to three statements treated as facts. He was also willing to give students answers to questions on worksheets, especially if there was more than one possible answer.

To conclude, in trying to understand how the subject matter of a class affected or interacted with the social organization of the classroom, it appears that this is a far more complex issue than was ever suspected. Subject matter is so interwoven into the social organization that it cannot be treated separately once it gets beyond the stage of teacher planning. We can see how the teachers use their knowledge of subject matter to organize their yearly and daily plans, but their goals, expectations, organizational structures, and negotiations with students in day-to-day life unify the event. Students talk about the math <u>class</u> and the social studies <u>class</u> as the meaningful events along with grades

and how they felt in the class. The actual subject matter becomes wrapped up in the class, and is difficult to talk about as a separate entities.